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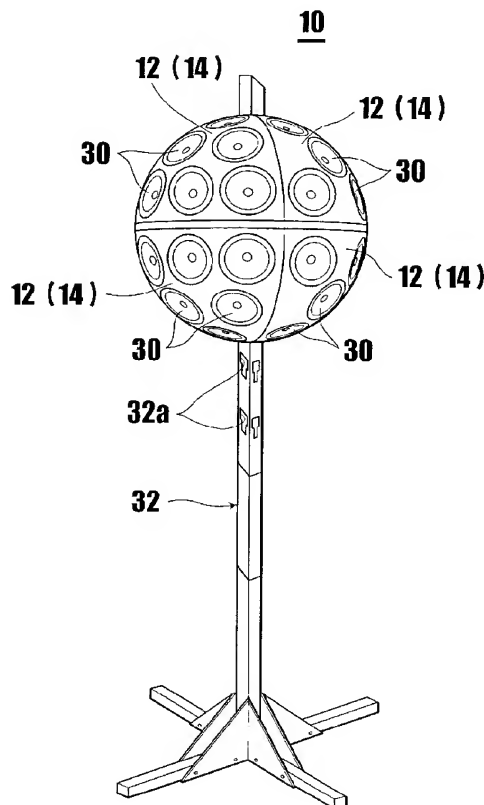
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(54) **Loudspeaker**

(57) The present invention provides a loudspeaker which comprises:

a plurality of octant loudspeakers which are pivotally connected with each other;  
 each octant loudspeaker having a vertical pivotal wall provided with a bracket having a pair of projections,  
 the octant loudspeaker including a plurality of loudspeaker drivers,  
 the octant loudspeaker being an octant hollow casing made of fibrous glass reinforced plastics and having a plurality of openings on a baffle for accommodating a loudspeaker driver,  
 said loudspeaker driver including a permanent magnet and a diaphragm having a voice coil bonded thereto and an electrical terminal provided on a horizontal face of the housing; and  
 a square strut having T-shaped notches on each side face which receive the projections of the brackets for mounting the octant loudspeakers on the strut.

**FIG. 1**



**Description**

[0001] This invention relates to a loudspeaker and more specifically, to a loudspeaker with which a directional characteristic pattern of sound can be obtained.

[0002] Sound reproduced from a sound source is propagated longitudinally as a spherical wave in the air, and it is attenuated in inverse proportion to a square of a distance.

[0003] In order to spread uniform sound widely in an auditorium or in the open air, it is necessary to install as many speakers as possible, each loudspeaker being capable of transmitting a high sound level and uniform and wide direction of the sound.

[0004] Loudspeaker cabinets should be mounted high up to avoid interference in sound transmission from a large audience or a building and also to increase sound clearness.

[0005] It is known that a single loudspeaker cannot reproduce the desired sound level and wide coverage required in large venues so that several (several to several tens of loudspeakers for a large audience of many thousands of people) loudspeakers must be provided.

[0006] In practise, a plurality of loudspeaker cabinets are mounted in a fanned or spherical shape in an auditorium in order not to cause phase interference with the sound emitted from the adjacent loudspeakers.

[0007] Conventionally, for large buildings such as a big auditorium, public facility or baseball park, special loudspeaker clusters including a plurality of accurately arranged loudspeaker cabinets are rigidly mounted on exclusive racks to transmit the desired high level sound.

[0008] For small and medium size buildings, loudspeaker cabinets are mounted on a base fixed at a wall, ceiling or rack respectively.

[0009] Alternatively, loudspeaker cabinets are located directly and rigidly on the wall, ceiling, beam or rack with bolts, nuts or wires which are fixedly inserted into the desired portion of the loudspeaker cabinets.

[0010] For simple buildings, ordinary small speaker cabinets are rigidly fixed on the walls, ceilings or racks with the special brackets or fittings therefor.

[0011] To this end, the exclusive releaseable hanging and fixing metallic brackets are used together with the ordinary wires, ropes or belts so that the loudspeaker cabinets may be located in the buildings in a fanned or spherical shape.

[0012] Some exclusive fanned hanging equipments have been proposed for the upper hanging racks (e.g. ELECTRO VOICE, TURBO SOUND, JBL, etc.).

[0013] The loudspeaker cabinets are hung rigidly in a fanned or spherical shape at the brackets with releaseable wires, ropes, belts, catches or fittings. For provisional acoustical facilities such as a large open-air concert hall or meeting, big loudspeaker cabinets which can be arranged or withdrawn easily have been proposed.

[0014] A plurality of ordinary speaker cabinets are hung in buildings such as an auditorium or a concert hall,

but they have the following disadvantages.

(a) It is necessary to prepare various devices to mount several loudspeaker cabinets either in a fanned or spherical shape in an open-air concert hall, or room in order to obtain a suitable acoustical effect.

To this end, elaborate preparation and careful design are necessary, it is very difficult to increase the number of loudspeakers and also to adjust them after mounting, and a staging is required for this work. In addition, expensive repair work is sometimes necessary on a large scale, and it should be remembered that each loudspeaker cabinet is rigidly mounted on the racks, thus making it impossible to adjust acoustical directional characteristics.

(b) Sound waves originating from a number of the neighbouring loudspeakers interfere with each other to produce phase interference by cross-feed delay between a peak and a dip of a sound wave. The more remarkable is the phase interference in the high sound range having a short wavelength, thus giving a big influence to frequency-to-directional characteristics, bringing forth a leaf- or lobe-shaped acoustical directional characteristics and also causing unfavourable influence such as difference of sound clearness at the various locations.

(c) It has been difficult for the conventional devices that the loudspeaker cabinets can be arranged in a fanned or spherical shape in the large buildings such as an auditorium, public facility or baseball park in such a manner that all of the central extension lines of the loudspeaker cabinets are converged into a focus. Additionally, increasing and removing work for the new loudspeaker cabinets cannot be easily carried out.

(d) It is easy to mount the desired number of the loudspeaker cabinets in the medium and small buildings, but the desired sound level and safety of the working could not have been obtained.

(e) Since the loudspeaker cabinet has a square or trapezoid shape, it is comparatively easy to mount a plurality of the loudspeaker cabinets in a fanned shape in a simple building, but it requires some specially prepared fittings to hang or to fly them to form a partially spherical surface of the loudspeaker cabinets.

[0015] There have been proposed some special brackets to arrange the adjacent loudspeaker cabinets, but it is possible to arrange only 2-4 loudspeaker cabinets in a row. Accordingly, where a higher sound level is required, it is necessary to replace the loudspeaker cabinets which have been already installed with cabinets having a higher sound level.

[0016] A principal object of this invention at least in its preferred forms, is to provide a globular and/or cylindrical loudspeaker comprising a plurality of octant and/or

cylindrical loudspeaker drivers and a strut for mounting the globular and/or cylindrical loudspeaker whereby a directional or omnidirectional, smooth, uniform and wide coverage of sound from the globular and/or cylindrical loudspeaker can be obtained.

[0017] Another object of this invention at least in its preferred forms is to provide a globular and/or cylindrical loudspeaker which can be placed either at a corner or at any desired position in an auditorium whereby a desired high level sound effect can be easily obtained from the adjacent loudspeakers in order to minimize a possible phase interference.

[0018] Another object of this invention at least in its preferred embodiments is to provide a globular and/or cylindrical loudspeaker comprising a plurality of globular and/or cylindrical loudspeaker drivers and a strut for mounting the globular and/or cylindrical loudspeaker whereby a height of the globular and/or cylindrical loudspeaker can be easily adjusted in order to obtain a precise directional characteristic.

[0019] Another object of this invention at least in its preferred embodiments is to provide a hemispherical loudspeaker comprising a pair of hemispherical loudspeakers whereby the desired directional characteristic can be adjusted in order to obtain a service area of 180 degrees and to avoid a possible phase interference of the sounds from the adjacent loudspeakers.

[0020] Another object of this invention at least in its preferred embodiments is to provide an octant loudspeaker which can be easily mounted into a corner portion of a ceiling and two walls of an auditorium.

[0021] Another object of this invention at least in its preferred embodiments is to provide a plurality of hemispherical loudspeakers which are mounted at each strut provided at a ceiling of an auditory room to obtain an omnidirectional service area of 380 degrees.

[0022] Still another object of this invention at least in its preferred embodiments is to provide a globular and/or cylindrical loudspeaker comprising a plurality of octant and/or cylindrical loudspeaker drivers which can be easily arranged at the desired position.

[0023] Thus from a first aspect, the present invention a globular loudspeaker for providing sound to a omnidirectional listening area, which comprises: a plurality of octant loudspeakers which are pivotally connected with each other; said octant loudspeaker having a vertical pivotal wall provided with a bracket having a pair of projections; said octant loudspeaker including a plurality of loudspeaker drivers; said octant loudspeaker being an octant hollow casing made of fibrous glass reinforced plastics and having a plurality of openings on a baffle for accommodating a loudspeaker drivers; said loudspeaker driver including a permanent magnet and a diaphragm having a voice coil bonded thereto and an electrical terminal provided on a quadrant horizontal face; and a square strut having T-shaped notches on each side faces for receiving said projections of the brackets for mounting said globular loudspeakers.

[0024] From a second aspect, the present invention provides a cylindrical loudspeaker for providing sound to a defined listening area, which comprises: a plurality of cylindrical loudspeakers which are pivotally connected with each other, and a plurality of octant loudspeakers which are connected to upper and lower portion of said cylindrical loudspeakers; said octant loudspeaker having a vertical pivotal wall provided with a bracket having a pair of projections; said cylindrical and octant loudspeaker including a plurality of loudspeaker drivers; said cylindrical and octant loudspeakers being an cylindrical and octant hollow casing made of fibrous glass reinforced plastics and having a plurality of openings on a baffle for accommodating a loudspeaker drivers; said loudspeaker driver including a permanent magnet and a diaphragm having a voice coil bonded thereto and an electrical terminal provided on a quadrant horizontal face; and a square strut having T-shaped notches on each side faces for receiving said projections of the brackets for mounting said cylindrical loudspeakers.

[0025] From a third aspect, the present invention provides a quadrant loudspeaker providing sound to a defined listening area, which comprises a bracket having a T-shaped bracket.

[0026] From a further aspect, the present invention provides a loudspeaker assembly comprising: a plurality of loudspeaker units; and a strut or bracket on which the loudspeaker units are mounted in use, each said loudspeaker unit comprising: a hollow housing having a curved outer surface forming a portion of a cylinder or sphere and comprising a baffle with one or more loudspeaker drivers mounted therein; and an inwardly located planar surface arranged to be mounted against the strut or bracket such that the curved outer surface of each said loudspeaker unit extends radially outwardly from the strut or bracket in use.

[0027] Preferred embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of a globular loudspeaker according to the invention mounted near a top portion of a square strut;

FIG. 2 is a perspective view of a hemispherical loudspeaker according to the invention mounted near a top portion of a square strut;

FIG. 3 is an enlarged decomposed perspective view of the globular loudspeaker and square strut shown in FIG. 1;

FIG. 4 is an enlarged perspective view of a hanger plate provided along a vertical pivotal wall of an octant loudspeaker;

FIG. 5 is a perspective view of an octant loudspeaker provided in a corner of a ceiling and two walls and a bracket for mounting the octant loudspeaker; FIG. 6 is a perspective view of a pair of octant loudspeakers provided in a corner of a ceiling and two walls and a bracket for mounting the octant globular

loudspeakers;

FIG. 7 is a perspective view of four octant loudspeaker drivers provided under a ceiling and a square strut for mounting the octant loudspeakers; FIG. 8 is a perspective view of a cylindrical loudspeaker of this invention; and

FIG. 9 is an enlarged decomposed perspective view of an octant loudspeaker driver and a quadrant cylindrical loudspeaker driver shown in FIG. 8,

**[0028]** Referring now to the drawings, FIG. 1-4 pictorially illustrate a globular loudspeaker 10 mounted near a top portion of a square strut 32 of this invention wherein an octant hollow casing 12 made of fibrous glass reinforced plastics includes a plurality of loudspeaker drivers 20 on a baffle 14 of the octant loudspeaker 12.

**[0029]** It should be noted that the octant hollow loudspeaker includes a plurality of openings on a baffle 14 for accommodating a loudspeaker driver 30 which comprises a permanent magnet and a diaphragm having a voice coil bonded thereto (both not shown).

**[0030]** The octant hollow loudspeaker 12 has a vertical pivotal wall 16, on which a bracket 20 having a pair of projections 20a, 20a at each end portion is integrally fixed.

**[0031]** Referring particularly to FIG. 3, an electrical terminal 18a is provided at a given position on a quadrant horizontal face 18 of the octant hollow loudspeakers 12.

**[0032]** A square strut 82 has a plurality of notch 32a, 32 on each side face for allowing insertion of the projections 20a, 20a of the bracket 20 so that the octant hollow loudspeakers 12, 12 may be pivotally assembled on the side faces to form a globular loudspeaker 12.

**[0033]** As shown in FIGS. 1 and 2, a lower square strut having a four-legged horizontal framework at its lowest portion is connected into the last but one square strut 32.

**[0034]** As shown in FIG. 2, a pair of upper octant hollow loudspeakers 12, 12 and a pair of lower octant loudspeakers 12, 12 are vertically and pivotally assembled and fixed near a top portion of the square strut 30 in order to assemble a hemispherical loudspeaker 12, thus obtaining a service area of 180 degrees and also avoiding a possible phase interference of the sound from the adjacent loudspeakers.

**[0035]** In FIG. 5, an octant loudspeaker 12 is provided into a corner portion of a ceiling and two walls of an auditorium by a bracket 11 having a pair of T-shaped notches 11a and 11b, which in turn is engaged with the projections 20a, 20a of the bracket 20 mounted on a vertical pivotal wall 16 of the octant loudspeaker 12,

**[0036]** In FIG. 6, a pair of octant loudspeakers 12, 12 is provided under a ceiling and a wall of an auditorium by a bracket 11 having a pair of T-shaped notches 11a and 11a, which in turn is engaged with the projections 20a, 20a of the bracket 20 mounted on a vertical pivotal wall 16 of the octant loudspeaker 12.

**[0037]** In FIG. 7, a hemispherical loudspeaker includ-

ing four octant loudspeakers 12, 12 is provided under a ceiling of an auditorium with a square strut 32 having notches 32a, 32 on its side face to obtain an omnidirectional service area of sound of 360 degrees.

**[0038]** With reference to an example shown in FIGS. 8 and 9, a cylindrical loudspeaker 40 comprises a plurality of quadrant loudspeakers B, B (44, 44) and a plurality of octant loudspeakers A, A (12, 12).

**[0039]** More precisely, the cylindrical loudspeaker 40 is a hollow body A which is made of fibrous glass reinforced plastics, each having a plurality of loudspeaker drivers 30, 30 on a baffle 40, an electrical terminal 18a provided at a given position on a quadrant horizontal face 18 and a vertical pivotal wall 16, on which a bracket 20 having a pair of projections 20a, 20a is vertically fixed.

**[0040]** A plurality of quadrant loudspeakers B, B (44, 44) and a plurality of octant loudspeakers A, A (12, 12) are assembled with each to form a cylindrical loudspeaker 40, and a top portion of the square strut 32 having a four-legged horizontal framework at its lowest portion is connected at a bottom portion of the cylindrical loudspeaker 40.

**[0041]** It can be noted that the square strut 32 can be extended or contracted.

**[0042]** It may be understood that a globular and/or cylindrical loudspeaker comprising a plurality of loudspeakers and a square strut 32 for mounting the globular and/or cylindrical loudspeaker can be easily assembled, located at the desired position of the auditorium, concert hall or outdoors, and the like, and mounted at a ceiling or a wall.

**[0043]** As desired, the globular and/or cylindrical loudspeaker 30, 40 can be easily located at a given place or in a corner of the auditorium, concert hall or the outdoors, thus enabling to deliver a directional, omnidirectional, smooth, uniform and wide coverage of sound.

**[0044]** In addition, the globular and/or cylindrical loudspeaker 80, 40 can be easily located either at a corner or at any desired position in an auditorium whereby a desired high level sound effect can be obtained from the adjacent loudspeakers in order to minimize a possible phase interference.

**[0045]** Since certain changes may be made in the above globular and/or cylindrical loudspeaker without departing from the scope of the invention herein claimed, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted in an illustrative and not in a limiting sense.

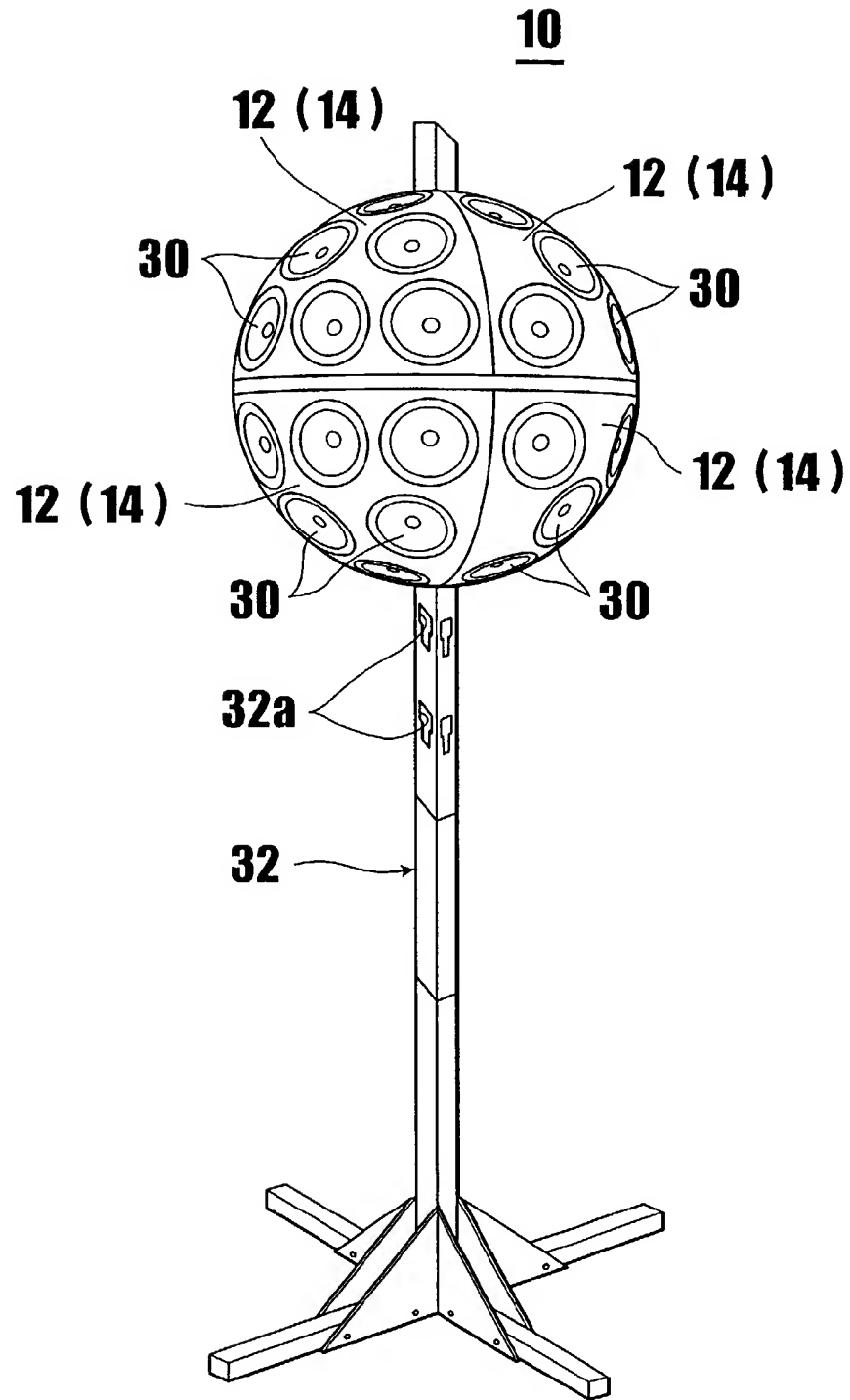
## Claims

1. A loudspeaker assembly (10) which comprises:

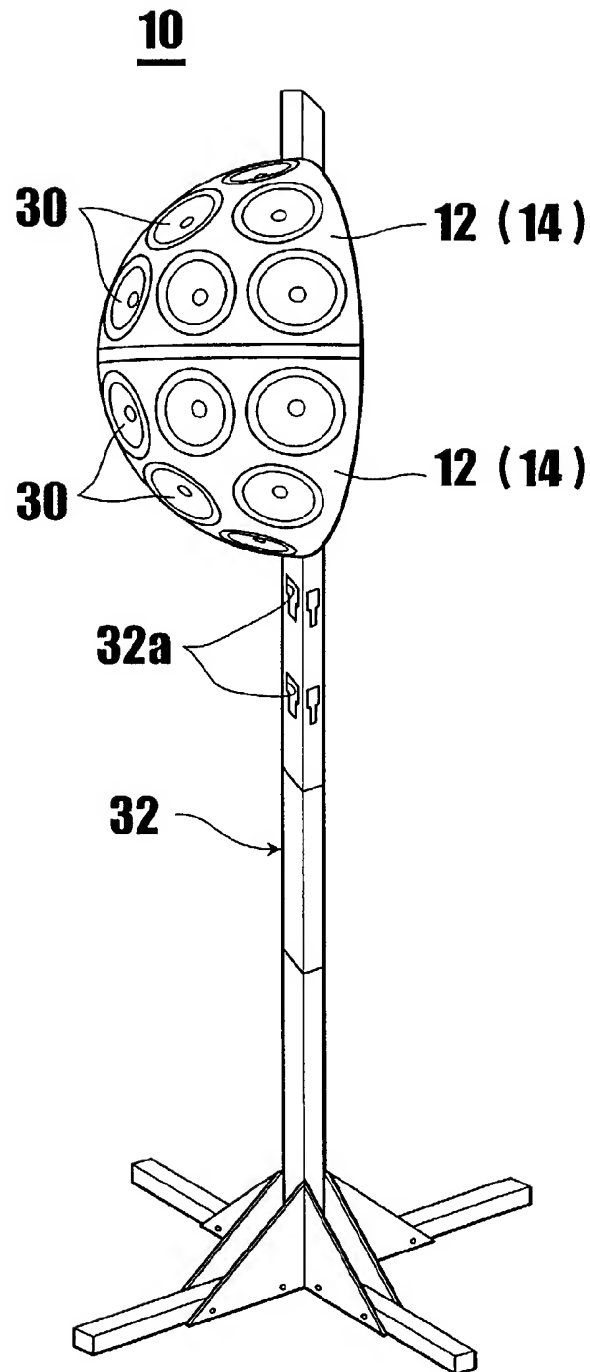
a plurality of octant loudspeakers (12) which are pivotally connected with each other,

- each said octant loudspeaker having a vertical pivotal wall (16) provided with a bracket (20) having a pair of projections (20a), said octant loudspeaker including a plurality of loudspeaker drivers (30), said octant loudspeaker being an octant hollow casing made of fibrous glass reinforced plastics and having a plurality of openings on a baffle (14) for accommodating a loudspeaker driver, said loudspeaker driver including a permanent magnet and a diaphragm having a voice coil bonded thereto and an electrical terminal (18a) provided on a horizontal face (18) of the housing; and a square strut (32) having T-shaped notches (32a) on each side face which receive said projections of the brackets for mounting said octant loudspeakers on said strut.
2. A loudspeaker assembly (10) as claimed in claim 1, which comprises a hemispherical loudspeaker mounted near a top end portion of said square strut (32).
  3. A cylindrical loudspeaker assembly (40) for providing sound to a defined listening area, which comprises:
    - a plurality of cylindrical loudspeakers (12) or loudspeakers (44) shaped as a portion of a cylinder which are pivotally connected with each other, and a plurality of octant loudspeakers (12) which are connected to upper and lower portions of said cylindrical loudspeakers each said loudspeaker having a vertical pivotal wall (16) provided with a bracket (20) having a pair of projections (20a), said cylindrical and octant loudspeakers including a plurality of loudspeaker drivers (30), each said cylindrical or part cylindrical and octant loudspeaker comprising a cylindrical or part cylindrical or octant hollow casing made of fibrous glass reinforced plastics and having a plurality of openings on a baffle (14) for accommodating a loudspeaker driver, said loudspeaker driver including a permanent magnet and a diaphragm having a voice coil bonded thereto and an electrical terminal (18a) provided on a horizontal face (18) of the housing; and a square strut (32) having T-shaped notches (32a) on each side faces for receiving said projections of the brackets for mounting said loudspeakers on said strut.
  4. A loudspeaker shaped as a quadrant of a cylinder or an eighth of a sphere for providing sound to a defined listening area, which comprises a bracket
- having a T-shaped bracket.
5. A semi-cylindrical loudspeaker, which comprises a pair of quadrant loudspeakers as claimed in claim 4 mounted on a T-shaped bracket (11).
  6. A cylindrical loudspeaker, which comprises four quadrant loudspeakers as claimed in claim 4, mounted on a square strut (32).
  7. A loudspeaker assembly (10,40) comprising:
    - a plurality of loudspeaker units (12,44); and a strut (32) or bracket (11) on which the loudspeaker units are mounted in use, each said loudspeaker unit comprising: a hollow housing having a curved outer surface forming a portion of a cylinder or sphere and comprising a baffle (14) with one or more loudspeaker drivers (30) mounted therein; and an inwardly located planar surface (16) arranged to be mounted against the strut or bracket such that the curved outer surface of each said loudspeaker unit extends radially outwardly from the strut or bracket in use.
  8. A loudspeaker assembly (10,40) as claimed in claim 7, at least some of said loudspeaker units being shaped substantially as one eighth of a sphere (12).
  9. A loudspeaker assembly (10,40) as claimed in claim 7 or 8, at least some of said loudspeaker units being shaped substantially as a quadrant of a cylinder (44).

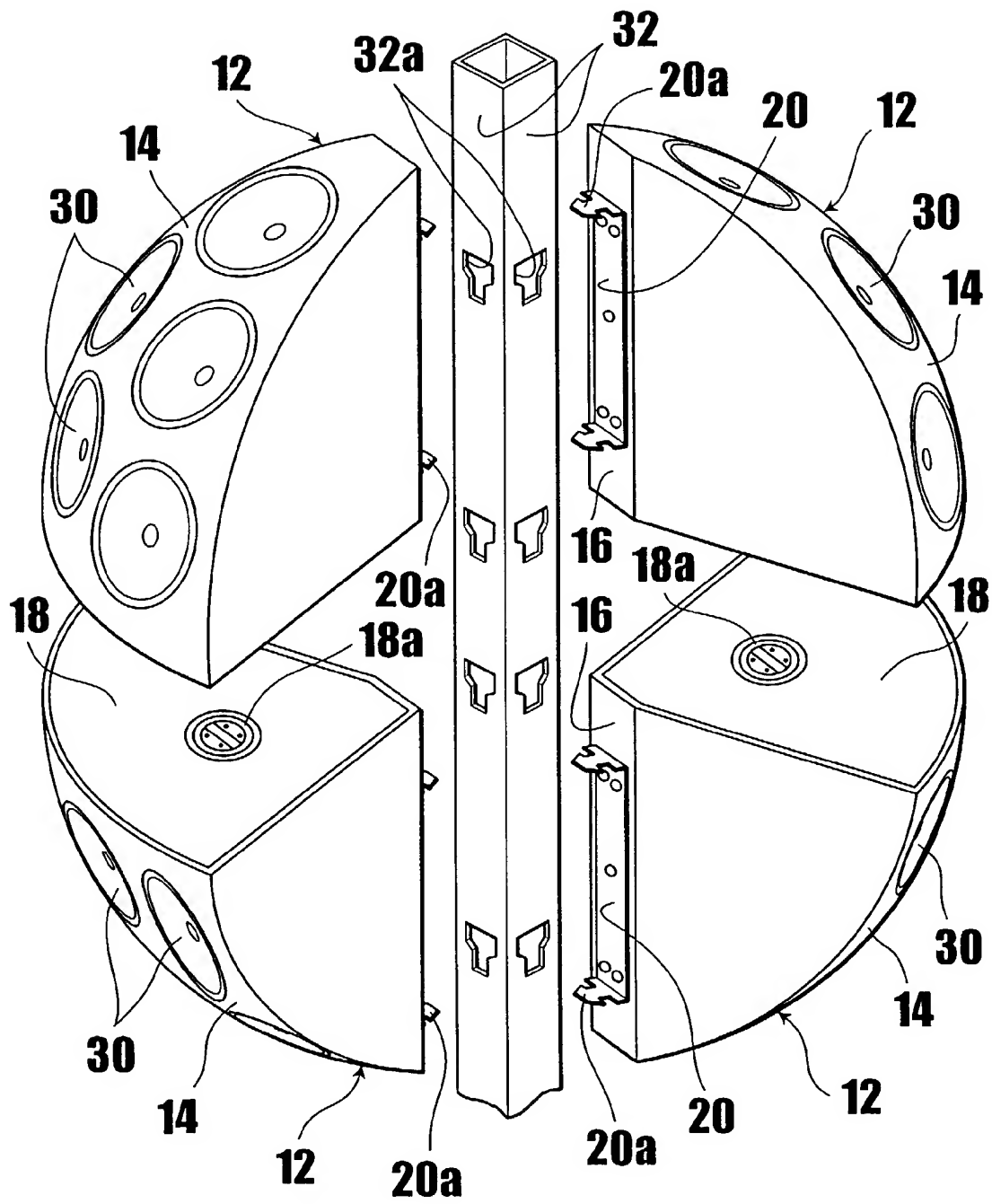
**FIG. 1**



**FIG. 2**

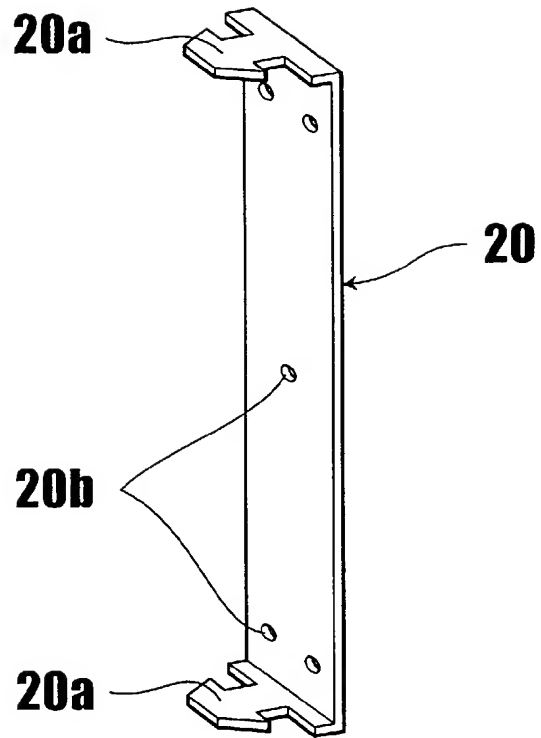


**FIG. 3**

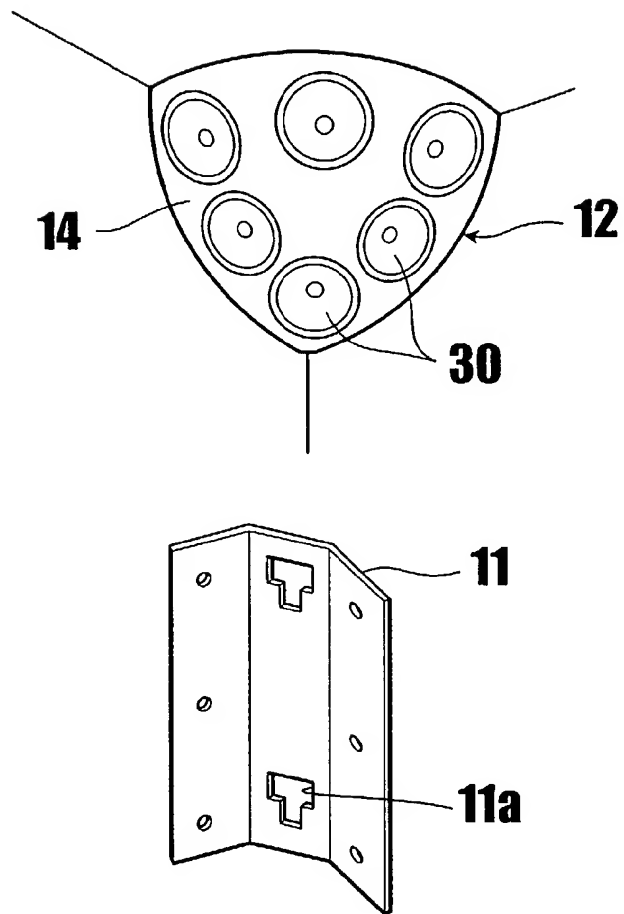




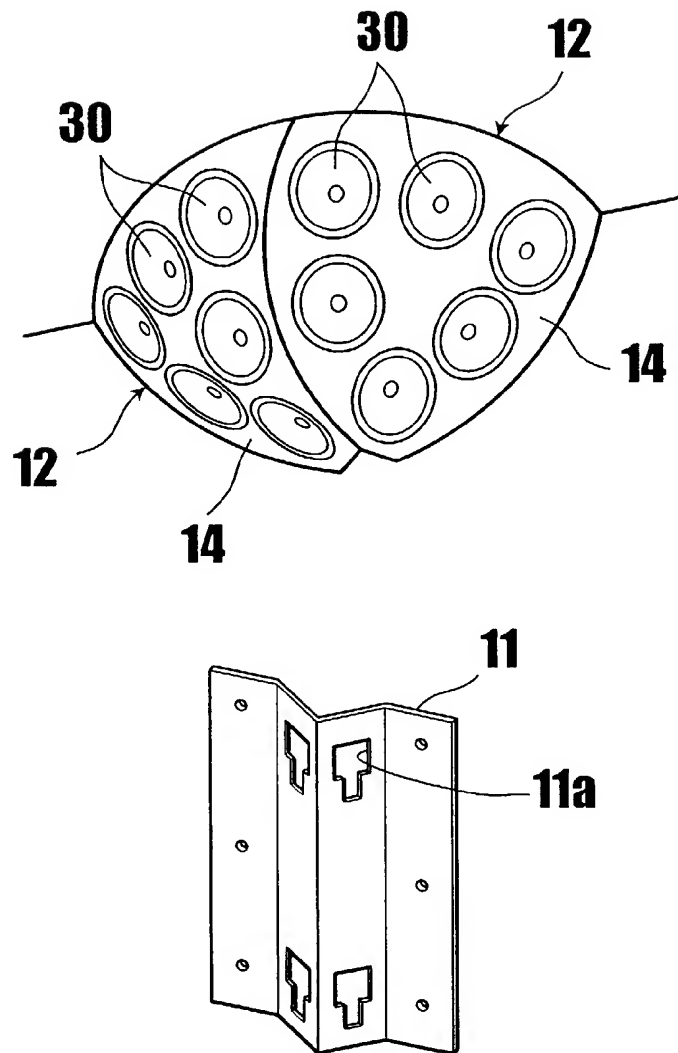
**FIG. 4**



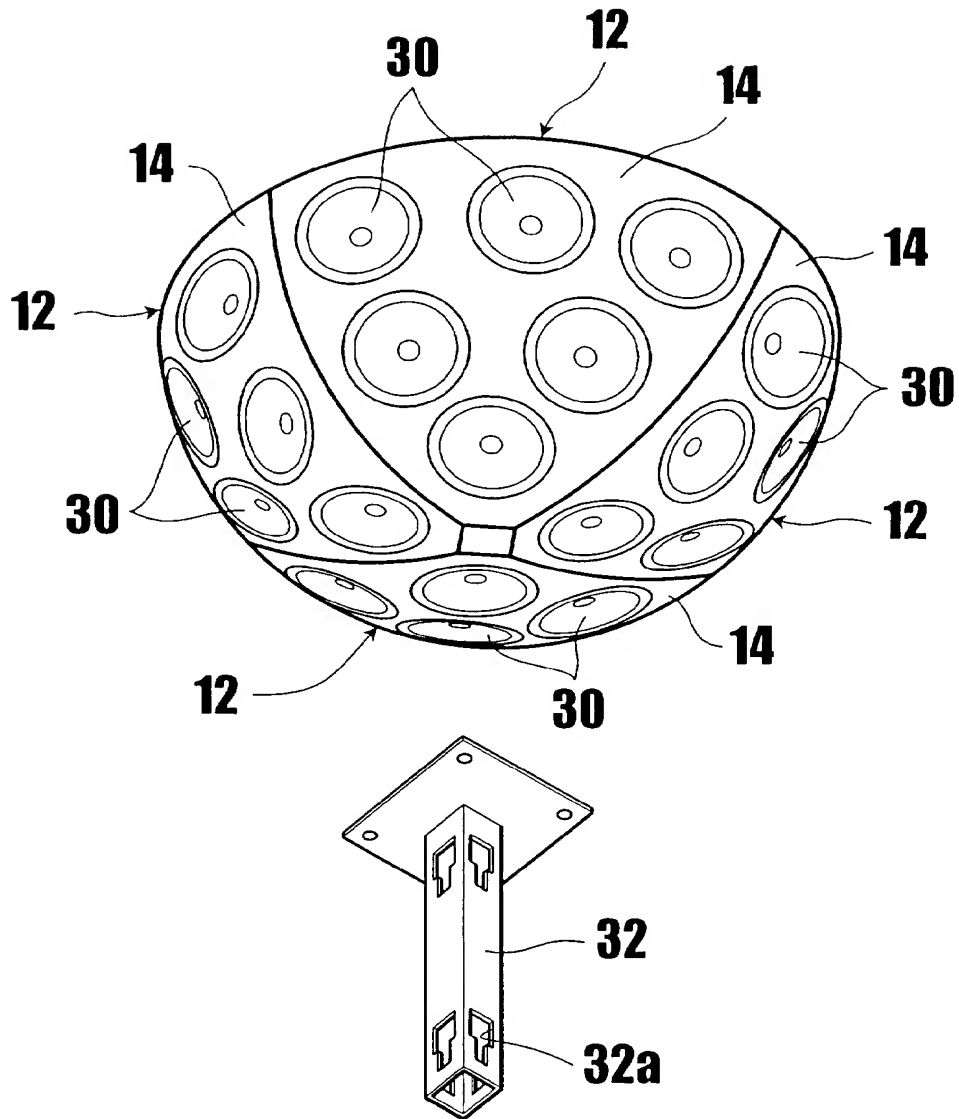
**FIG. 5**



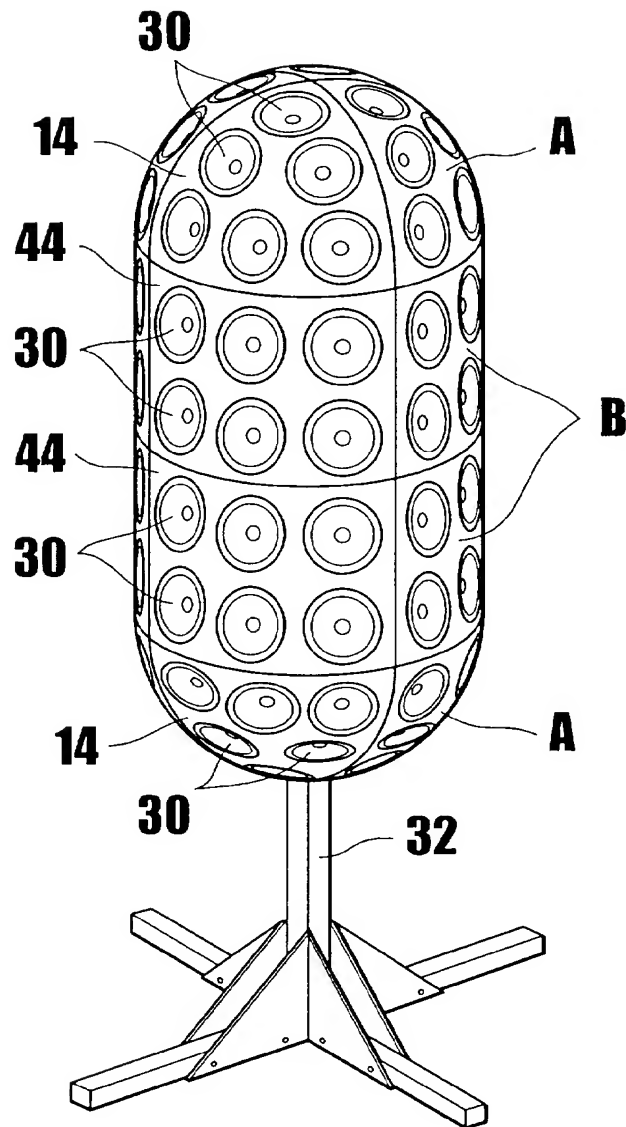
**FIG. 6**



**FIG. 7**



**FIG. 8**



**FIG. 9**

